Space Weather Technical Forecast

Issued on Tuesday, 20 August 2024 at 13:08 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: R1/R2 flares expected, chance of R3 flares, risk reducing slightly. Slight chance of G1/Minor Storms from Day 2 (21 Aug). Chance of exceeding S1/Minor Radiation Storm.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Moderate, with the peak flare M3.7 at 19/2152UTC from AR3796. There are now twelve regions on the visible disc, with hints of another region just on the east limb. AR3784 approaching the northwest limb is now difficult to analyse due to the viewing angle, but appears to remain a complex region with the potential for large flares. There are also two somewhat complex groups in the southeast, with AR3790 showing mixed polarities in the centre of the group. although no obvious delta, and AR3796 starting to rotate into a better view and perhaps having a delta in the centre of the spot region, although this is not yet completely clear. The other sunspot regions are either smaller or less complex.
A CME seen emerging to the southeast likely originated from a dimming near AR3790 around 20/0200 UTC. This may give some glancing influence at Earth, perhaps later on Day 4 (23 Aug), but analysis of this feature is ongoing.
Solar Wind / Geomagnetic Activity: The solar wind, as measured by ACE at L1, showed a slow regime. The solar wind speed varied between 320-430 km/s. The density was mainly average or below. The Interplanetary Magnetic Field was mainly weak, below 8nT. The north-south component varied weakly but was mostly southward directed, between +4/-7nT The phi angle was positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3).
Energetic Particles / Solar Radiation: High energy (greater than 10 MeV) proton flux observed by GOES18 remained at background levels.
High energy electron flux (greater than 2MeV) observed at GOES16 was at background levels.
The 24-hour fluence was below the Active threshold, with 8.18e5 integrated pfu observed at 20/0000UTC.

Four-Day Space Weather Forecast Summary
Solar Activity: M-class flares are expected with a chance of X-flares, however the departure of AR3784 should see a slight dip in daily risks.
Solar Wind /Geomagnetic Activity: The geomagnetic forecast is of lower-than-average confidence in detail for this period. A CME occurring around 17/1030UTC has a small chance of giving glancing impacts on Day 2 (21 Aug). A further CME seen emerging to the southeast around 20/0200 UTC may give some glancing influence at Earth, perhaps later on Day 4 (23 Aug), but analysis of this feature is ongoing.
Some HSS influence from CH60/+ is likely early on Day 3, perhaps combining with the CME from 17 August. A second fast wind from CH61/+ may again combine with any CME influence from 20 August to bring some increased activity later on Day 4.
Largely Quiet activity is expected at first, perhaps increasing to Unsettled to Active with a slight chance of G1/Minor Storm intervals through Days 2 to 4 under various potential CME and HSS features.
Energetic Particles / Solar Radiation: High energy proton flux is likely to remain at background levels, with a chance of exceeding the S1/Minor solar radiation storm level should any notable

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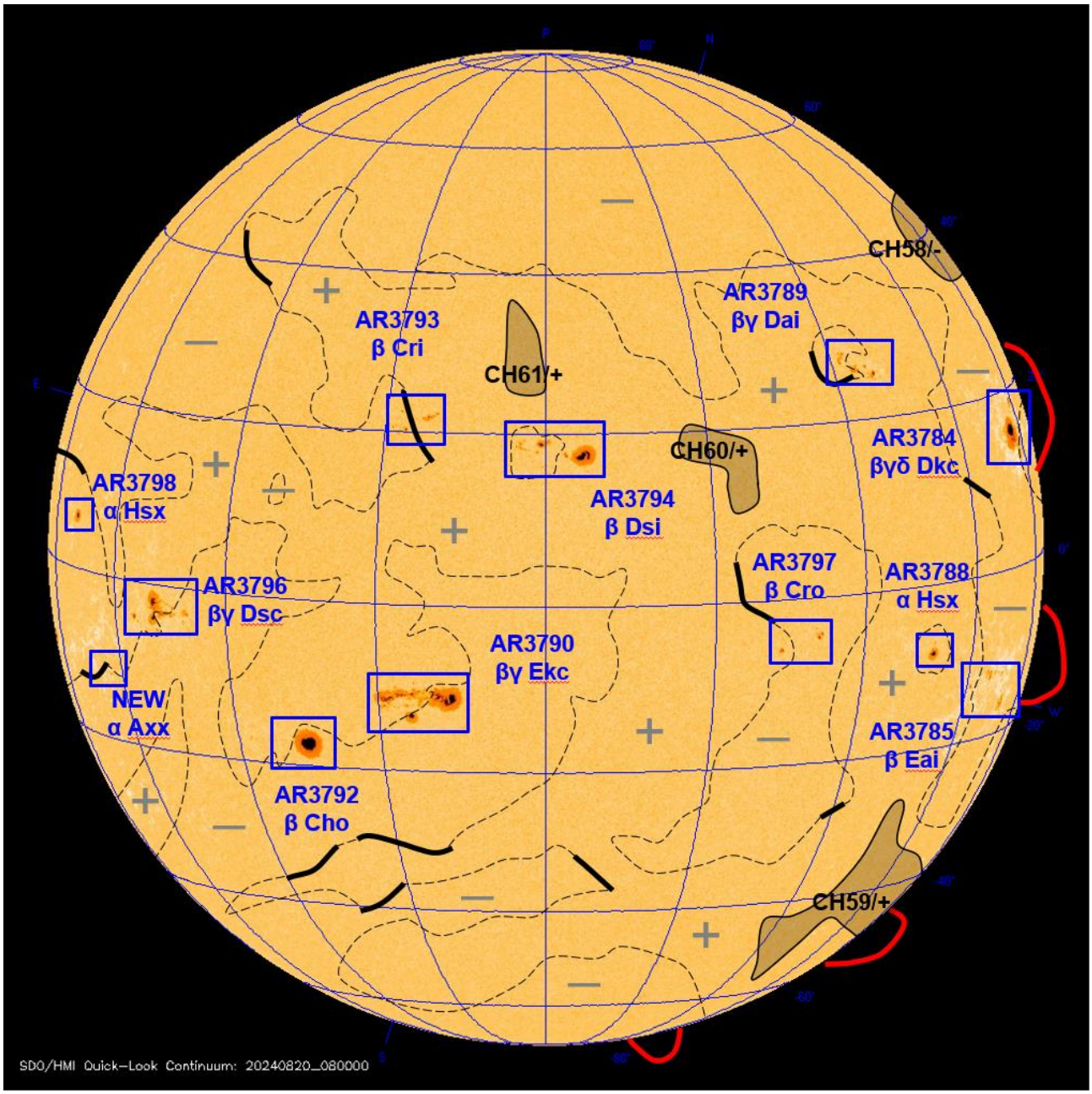
flares occur.
High energy electron flux is expected to remain at background levels. The associated 24-hour fluence is expected to be below the Active level.

Figure 1. Solar Analysis Valid 20/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Met Office Space Weather Technical Forecast

Geomagnetic Storms:

The geomagnetic forecast is of lower-than-average confidence in detail for this period. The reasons for uncertainty are: the large number of minor transients observed in coronagraph imagery; the marginal nature of the two potentially inbound CMEs; and finally due to the altering shape of the two coronal holes, CH60/+ and CH61/+. There was some potentially High Speed Stream (HSS) related influence on the last rotation, although with an uncertain source at that time as no coronal holes were visible on the disc.

A CME emerged from a broad upper coronal reconfiguration, occurring around 17/1030UTC across a large span of 40N. This resultant CME is most likely to stay above the ecliptic plane, but has a small chance of giving glancing impacts on Day 2 (21 Aug) - particularly should it interact with the fast wind from CH60/+.

A further CME seen emerging to the southeast after a dimming from AR3790 around 20/0200 UTC may give some glancing influence at Earth, perhaps later on Day 4 (23 Aug), but analysis of this feature is ongoing.

Some HSS influence from CH60/+ is likely early on Day 3, perhaps combining with the CME from 17 August, although with low confidence in the arrival time and peak wind speeds. A second fast wind from a similarly minor coronal hole (CH61/+) will most likely arrive around 36-48 hours after the onset of CH60/+, but may again combine with any CME influence from the CME on 20 August to bring some increased activity later on Day 4.

Largely Quiet activity is expected at first, perhaps increasing to Unsettled to Active with a slight chance of G1/Minor Storm intervals through Days 2 to 4 under various potential CME and HSS features.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	10	20	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
17/2001	Partial	High coronal	40N across centre disc	368 km/s	Crosses 1AU 21/1200 UTC	Possibly a miss, but may interact with CH60/+

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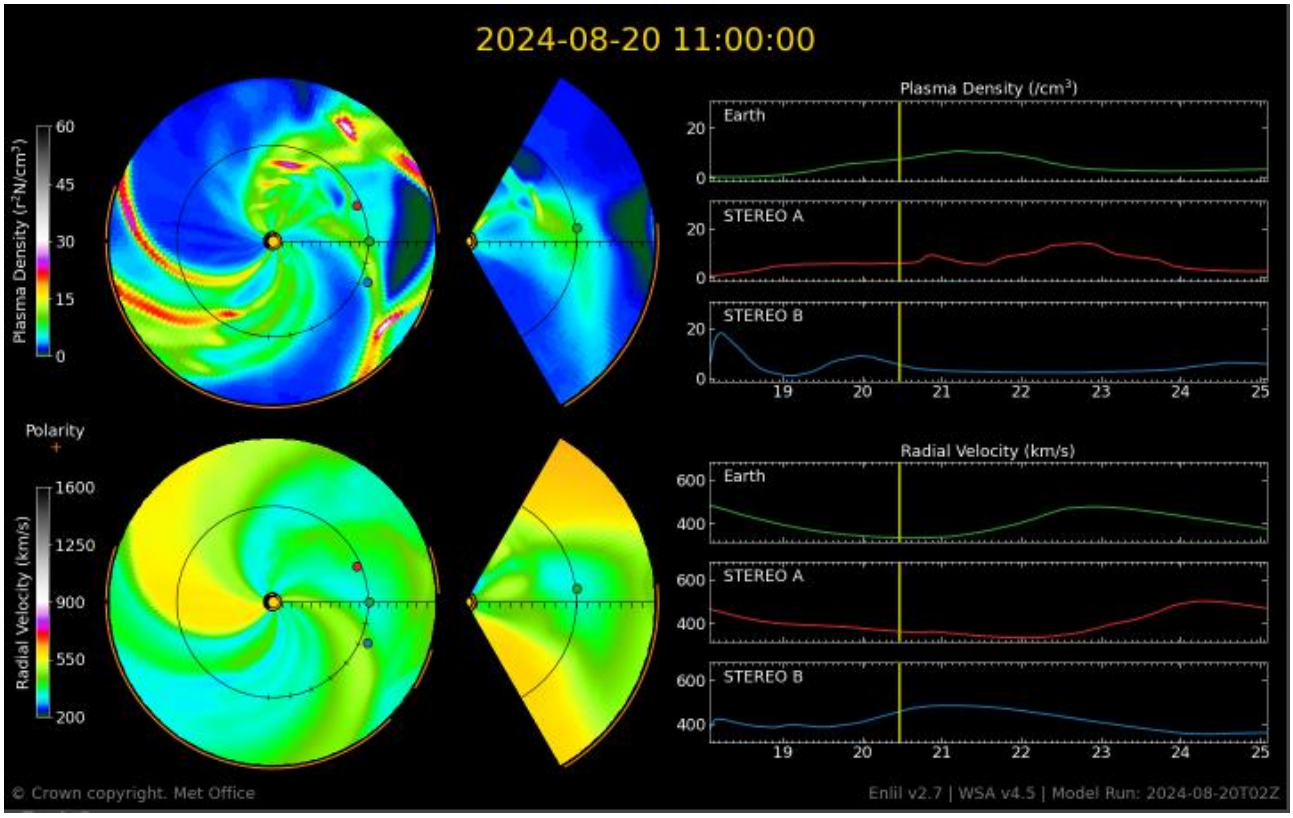
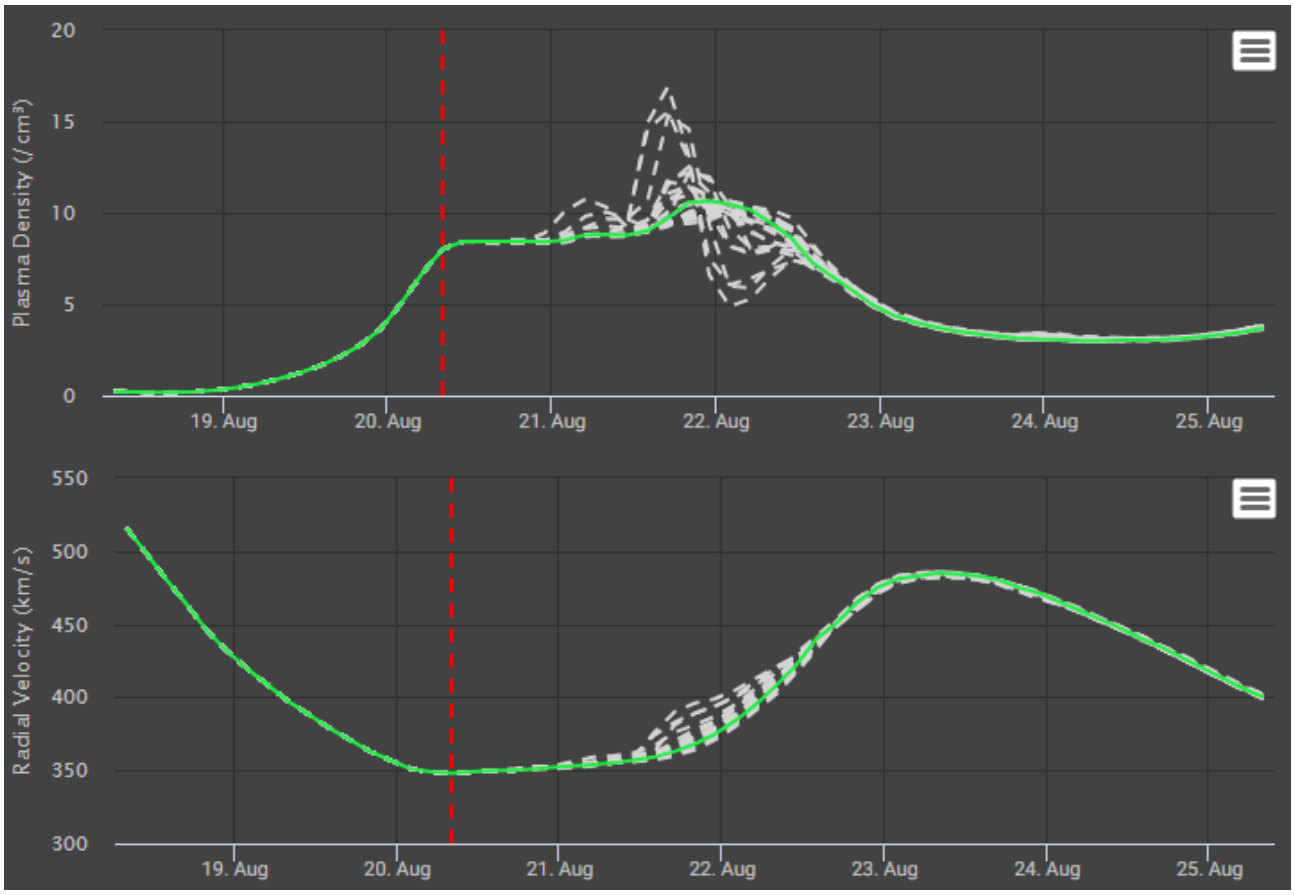
Figure 2: MOSWOC Enlil and ensemble, showing potential CME and HSS features. The second CME from 20 August is not yet modelled.





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Radio Blackouts - X-Ray Flares:
There are now twelve regions on the visible disc, with hints of another region just on the east limb. AR3784 approaching the northwest limb is now difficult to analyse due to the viewing angle, but appears to remain a complex region with the potential for large flares. There are also two somewhat complex groups in the southeast, with AR3790 showing mixed polarities in the centre of the group. although no obvious delta, and AR3796 starting to rotate into a better view and perhaps having a delta in the centre of the spot region, although this is not yet completely clear. The other sunspot regions are either smaller or less complex.

The trend in X-ray activity should be slightly downward over the four days as AR3784 and then AR3785 rotate off the disc on Days 2-3 (21-22 Aug), with few new regions signalled to arrive over the eastern horizon from far-side soundings or returning regions.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	80	80	75	60
Very Active	R3 to R5 X Class	No	25	25	20	15

Figure 3: X-ray flux at GOES16 and 18, showing Moderate-class flares.

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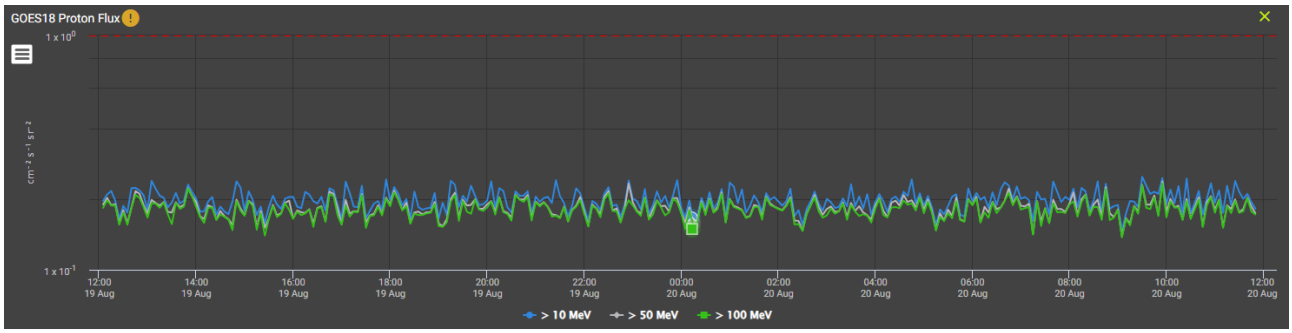
Solar Radiation Storms - (High Energy Protons):
High energy proton flux at GOES18 is likely to persist at background levels, but with a chance of rising in response to any notable flares.

AR3784 approaching the northwest limb is the main region of interest for proton flux risk at present, with this risk slowly reducing once it gets well past the limb later in this period. However, AR3790 is due to rotate into the western disc on Day 2 (21 Aug), with a gradually increasing risk of proton events from this feature which will partially balance the reducing risk from AR3784.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	25	25	25	20
Very Active	**≥ S3 ***	No	5	5	5	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Proton flux at GOES18, which is currently at background levels.



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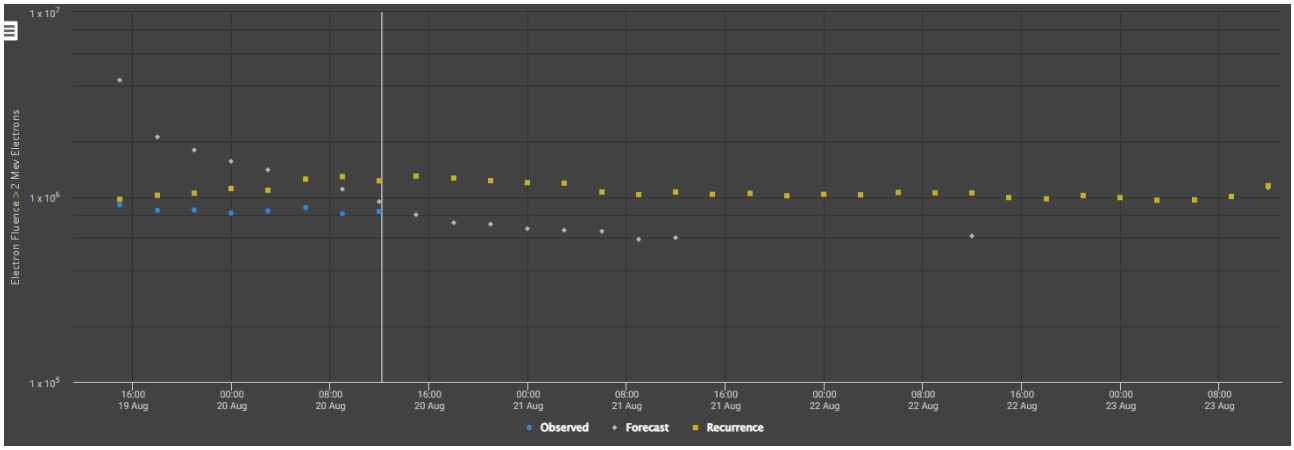
High Energy Electrons Event (≥ 2MeV):
The high energy electron forecast is of low confidence. Current background electron flux levels are now considered likely to remain that way after recent CME effects, as the solar winds have now returned to background levels. Upcoming potential CME and HSS influence is expected to keep flux levels at background in the short term. A response to any HSS influence is possible, but unlikely until after the end of this period.

As such, the fluence is expected to remain below the Active (1e8 integrated pfu) through the rest of this period.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM, showing a below Active forecast.



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